

## NISTTech

### An In-line Optical Cell for Monitoring Precursor Flux During Semiconductor Deposition Processes

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#### Improves signal to noise in optical spectroscopy of gas cells

#### Description

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The invention is an optical cell that facilitates more precise measurement of the delivery rate of a low-volatility precursor material used during a semiconductor fabrication process involving thin-film, vapor deposition. The device reduces the detrimental effect of beam steering in a high-sensitivity optical spectroscope operating at elevated temperature. Pairs of transparent optical windows, in which the air between the windows is evacuated, separate the heated precursor gas from the surrounding ambient gas. This nearly eliminates thermal gradients in the ambient gas and the consequent variations of refractive index, thereby reducing signal noise in the measuring system.

#### Applications

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- **Semiconductor vapor deposition processes, such as chemical vapor deposition and atomic layer deposition.**

#### Advantages

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- **By improving the ability to reproducibly deliver a known amount of reactant to a semiconductor deposition surface, the desired film properties are more achievable**
- **The process operator can identify when a precursor reservoir is depleted, thereby allowing more timely termination of process runs and more efficient use of precursors**
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#### Abstract

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A method is described to improve the signal-to-noise ratio (SNR) in high sensitivity optical spectroscopy of gas cells at elevated temperatures in which a beam of electromagnetic radiation propagates through both an ambient gas and an analyte in the gas cell. In such systems, beam steering of the electromagnetic radiation due to thermal gradient-induced refractive index variations in the ambient gas can be a significant source of noise when optical ports are located in close proximity to heated zones. In order to reduce beam steering, an optical port arrangement involving a pair of transparent windows with an intervening vacuum is employed: one window located in a heated zone and separated by a vacuum from a second (thermally isolated) window located in an area free of significant thermal gradients.

#### Inventors

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#### References

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- Patent Application 13/180,455
- Docket: 10-009

#### Status of Availability

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This invention is available for licensing exclusively or non-exclusively in any field of use.

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